

## Procedure to calculate 95% CL<sub>s</sub> contour

Following the naming convention in the supplemental data file, six columns are denoted as  $\log_{10}(\sin^2(2\theta_{14}))$ ,  $\log_{10}(\Delta m_{41}^2)$ ,  $\chi_0^2$ ,  $\chi_1^2$ ,  $\chi_2^2$  and  $\chi_3^2$ .

For each grid point in the  $(\sin^2 2\theta_{14}, \Delta m_{41}^2)$  phase space, calculate

1.  $\Delta\chi_{data}^2 = \chi_0^2 - \chi_1^2$  for data
2.  $\Delta\chi_{H_0}^2 = \chi_2^2$  using Asimov MC set assuming H<sub>0</sub> ( $3\nu$ ) is true
3.  $\Delta\chi_{H_1}^2 = -\chi_3^2$  using Asimov MC set assuming H<sub>1</sub> ( $4\nu$ ) is true

$$4. \text{ CL}_s = \frac{1-p_1}{1-p_0} = \frac{1+\text{erf}\left(\frac{\Delta\chi_{H_1}^2 - \Delta\chi_{data}^2}{\sqrt{8|\Delta\chi_{H_1}^2|}}\right)}{1+\text{erf}\left(\frac{\Delta\chi_{H_0}^2 - \Delta\chi_{data}^2}{\sqrt{8|\Delta\chi_{H_0}^2|}}\right)}$$

5. set  $\text{CL}_s < 0.05$  for 95% CL<sub>s</sub> limit contour